US011051007B2

(12) **United States Patent**
Cho et al.

(10) **Patent No.: US 11,051,007 B2**
(45) **Date of Patent: Jun. 29, 2021**

(54) **IMAGE-CAPTURE TESTING DEVICE AND SYSTEM**

(71) Applicant: **TRIPLE WIN TECHNOLOGY(SHENZHEN) CO.LTD.**, Shenzhen (CN)

(72) Inventors: **Yu-An Cho**, New Taipei (TW); **Wen-Chieh Lin**, New Taipei (TW); **Ye-Quang Chen**, New Taipei (TW)

(73) Assignee: **TRIPLE WIN TECHNOLOGY(SHENZHEN) CO.LTD.**, Shenzhen (CN)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/699,948**

(22) Filed: **Dec. 2, 2019**

(65) **Prior Publication Data**

US 2021/0136355 A1 May 6, 2021

(30) **Foreign Application Priority Data**

Oct. 30, 2019 (CN) 201911047075.4

(51) **Int. Cl.**
H04N 17/00 (2006.01)
G06T 7/00 (2017.01)

(52) **U.S. Cl.**
CPC ***H04N 17/002*** (2013.01); ***G06T 7/0002*** (2013.01); *G06T 2207/30168* (2013.01)

(58) **Field of Classification Search**
CPC .. H04N 17/002; H04N 13/246; G06T 7/0002; G06T 2207/30168
USPC 348/187, 189, 180, 181, 92
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,225,977	B2 *	12/2015	Lewinnek	H04N 17/002
10,478,137	B2 *	11/2019	Liu	A61B 5/0035
2014/0240518	A1 *	8/2014	Lewinnek	H04N 17/002 348/187
2014/0240519	A1 *	8/2014	Lewinnek	H04N 5/2257 348/187
2015/0049188	A1 *	2/2015	Harrell	F16M 11/18 348/139
2015/0092906	A1 *	4/2015	Liu	A61B 6/4417 378/4

FOREIGN PATENT DOCUMENTS

TW M534485 U 12/2016

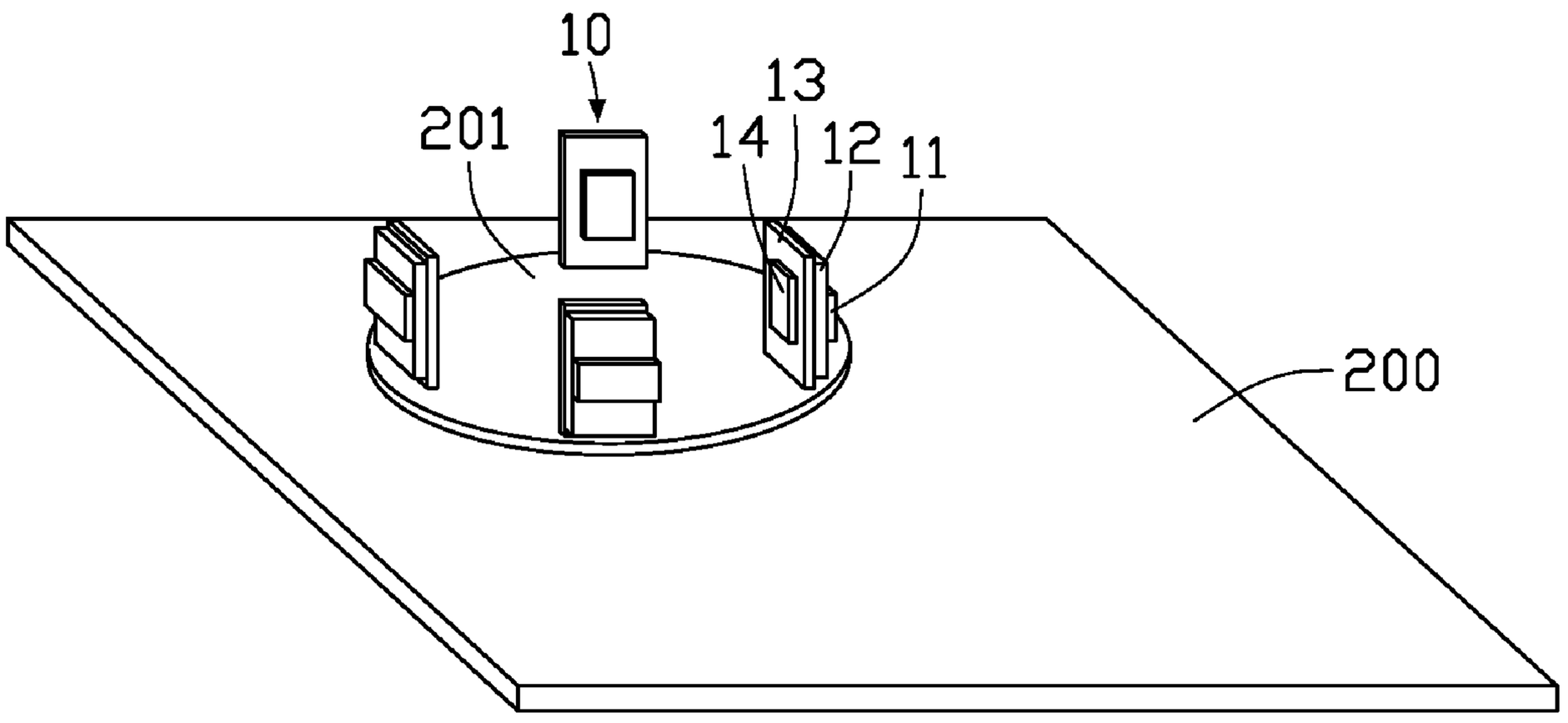
* cited by examiner

Primary Examiner — Paulos M Natnael
(74) *Attorney, Agent, or Firm* — ScienBiziP, P.C.

(57) **ABSTRACT**

A device to test image-capturing abilities of photosensitive components includes a movable assembly and a fixing assembly. The movable assembly includes a first wireless transmission module. The fixing assembly comprises a second wireless transmission module. The second wireless transmission module is wirelessly connected to the first wireless transmission module avoiding wire entanglement or winding as the movable assembly is rotated. The first wireless transmission module receives image signals from a camera module and wirelessly sends the image signals to the second wireless transmission module.

8 Claims, 6 Drawing Sheets



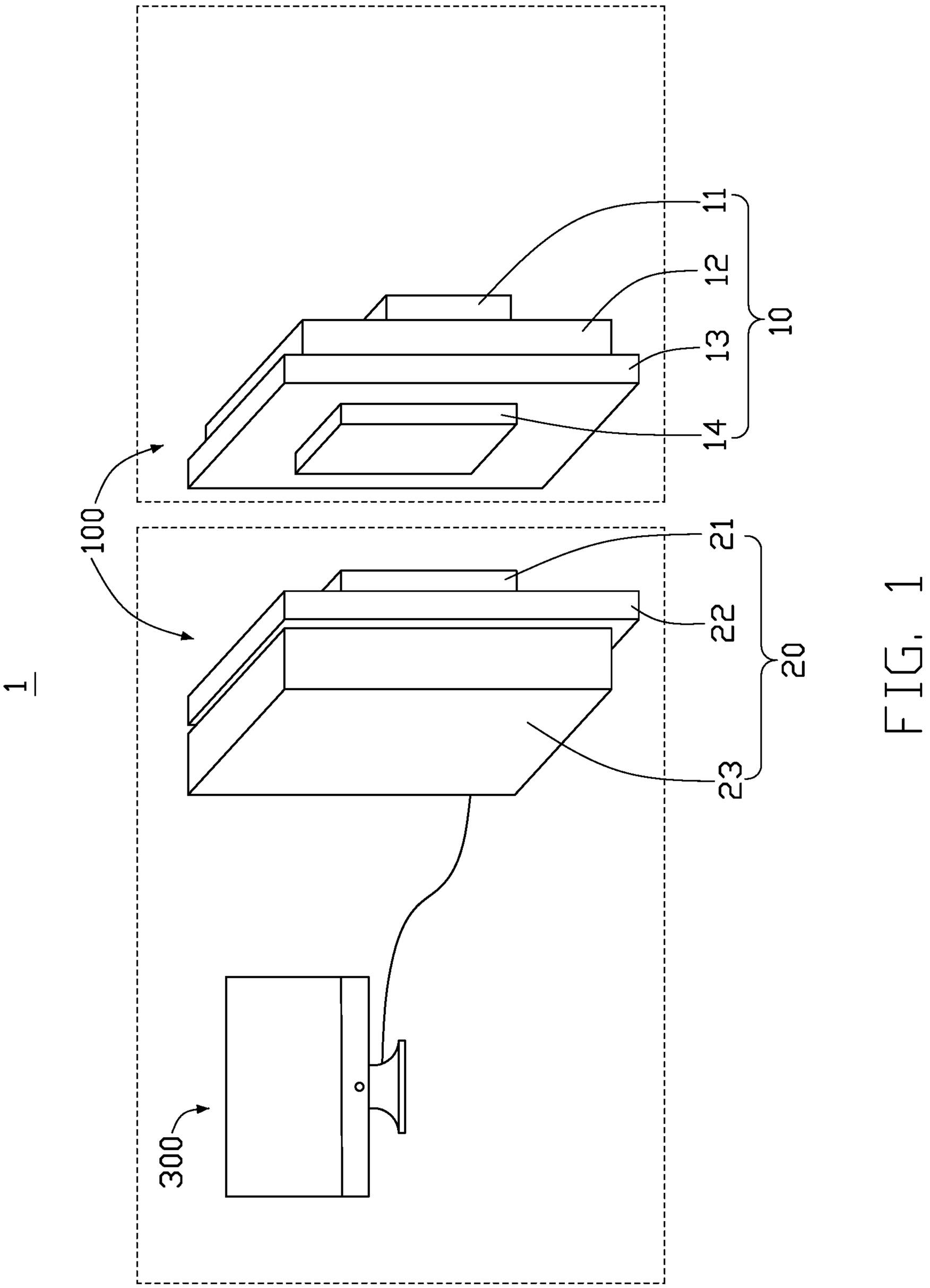


FIG. 1

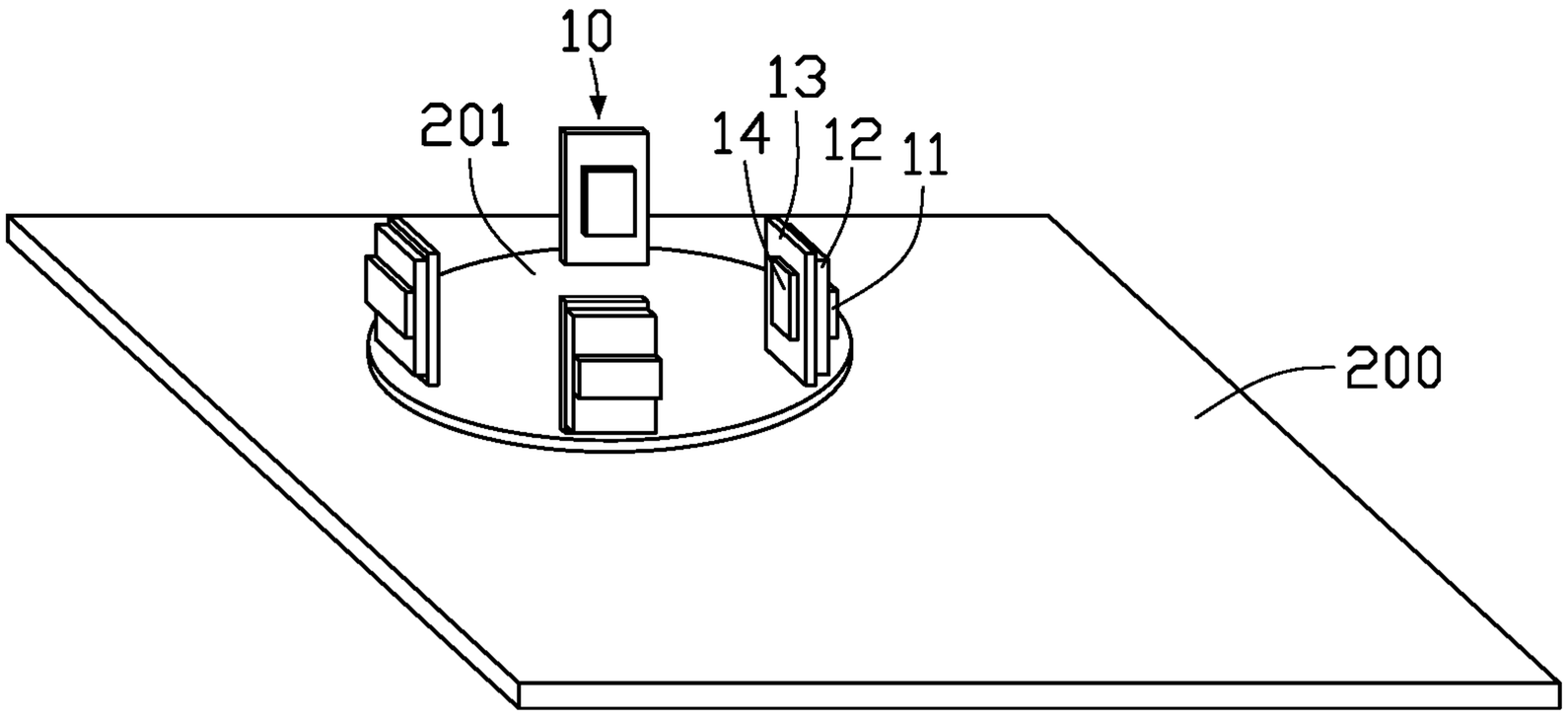


FIG. 2

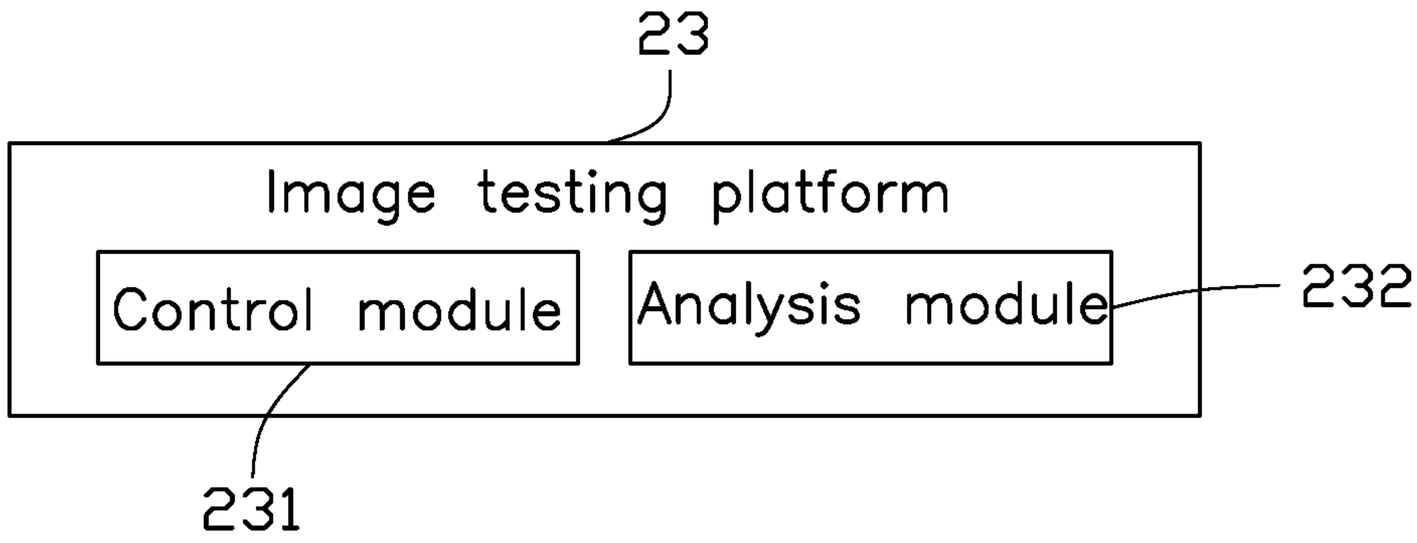

23
Image testing platform
Control module
Analysis module
232
231

FIG. 3

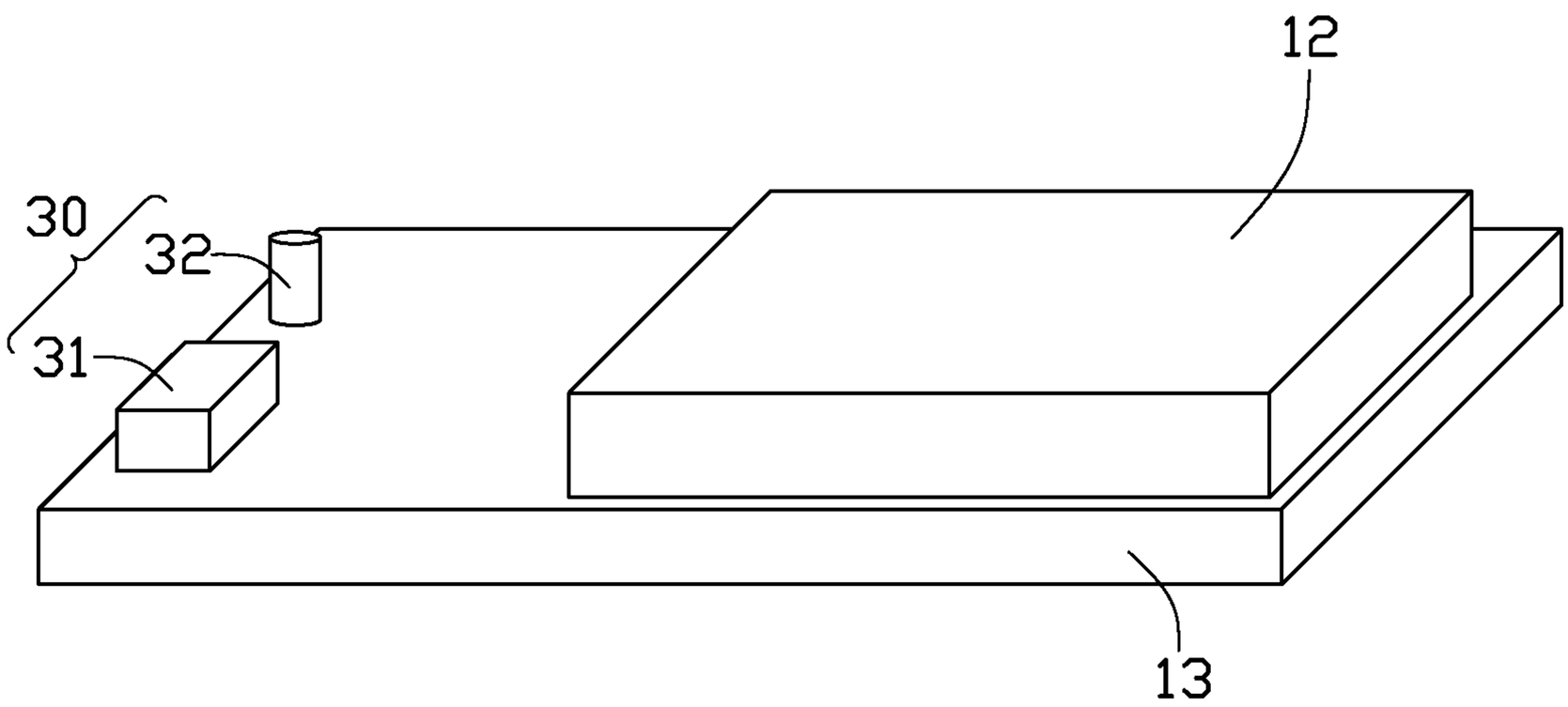


FIG. 4

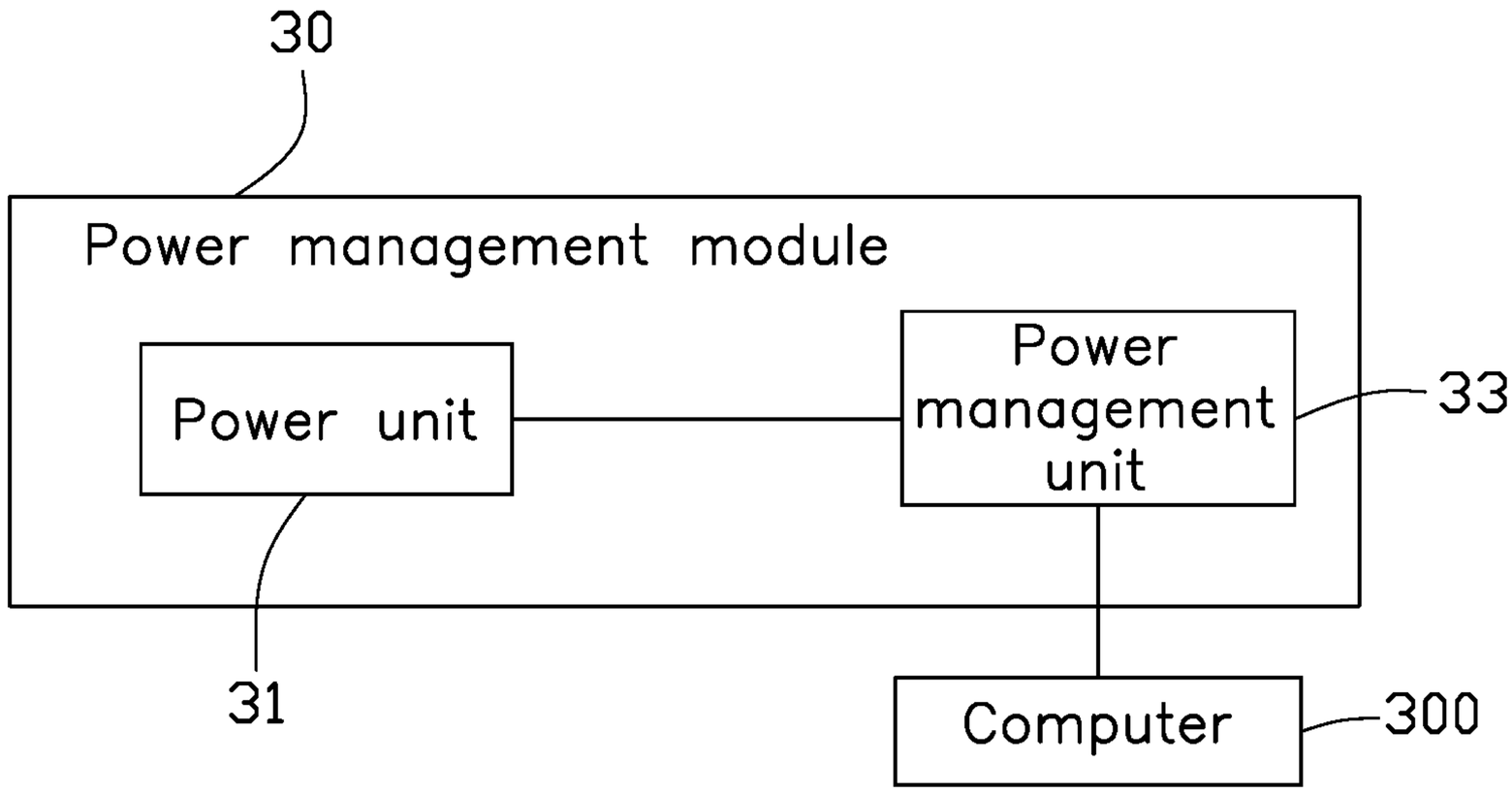

30
Power management module
Power unit
Power management unit
33
31
Computer
300

FIG. 5

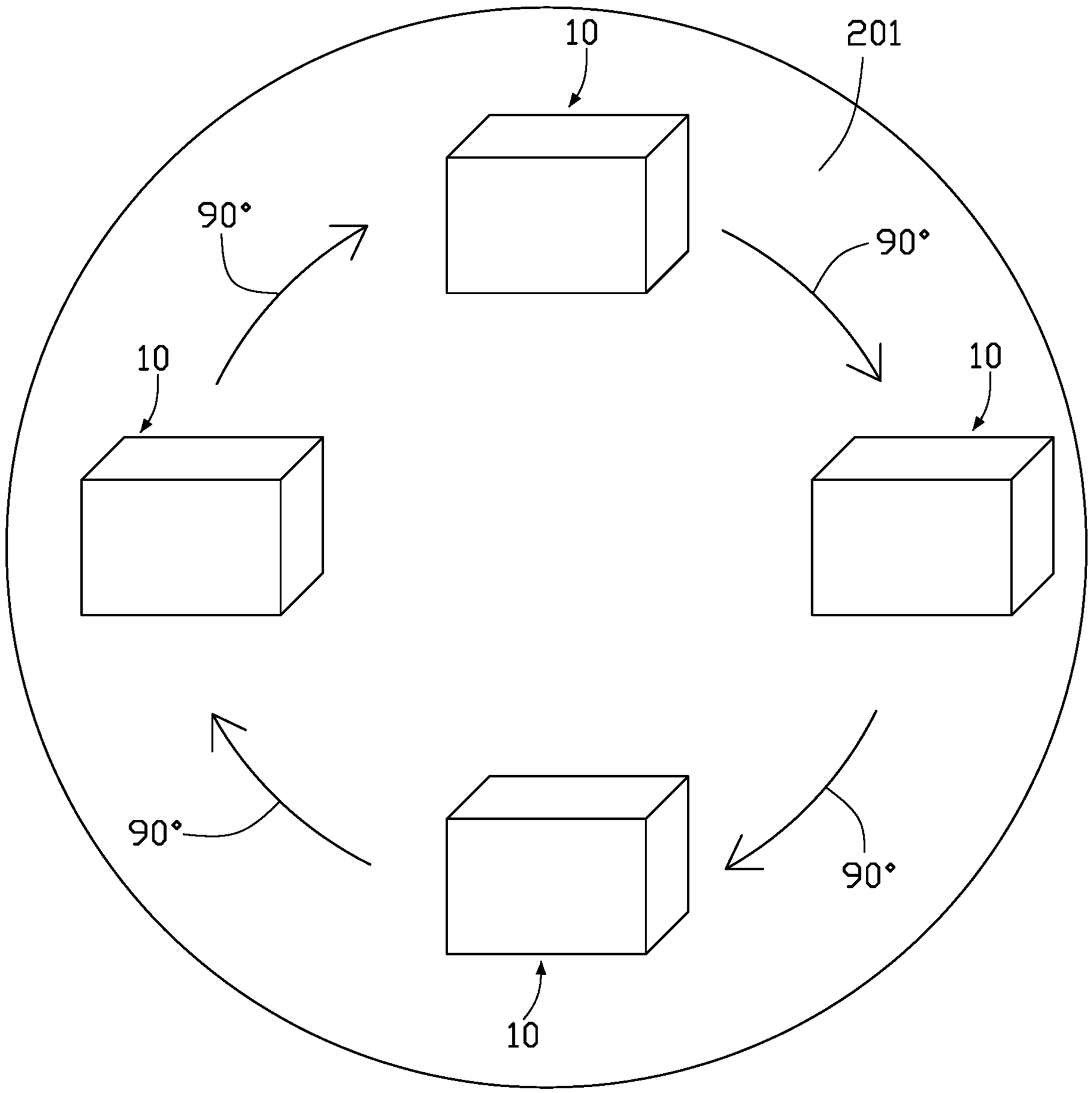


FIG. 6

IMAGE-CAPTURE TESTING DEVICE AND SYSTEM

FIELD

The subject matter herein generally relates to component testing, and in particular to an image-capture testing device and system for data transmission using a wireless transmission chip.

BACKGROUND

When a machine uses four image-capture test platforms, to prevent signal lines of the machine being wound up during rotation, the machine must rotate 270 degrees first and then rotate back to 0 degrees. However, such a configuration mat adversely affect the speed of testing, so that the machine has a slower speed for data transmitting and a lower efficiency.

Therefore, there is room for improvement within the art.

BRIEF DESCRIPTION OF THE DRAWING

Many aspects of the disclosure can be better understood with reference to the figure. The components in the figures are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the disclosure.

FIG. **1** is a schematic diagram of an image-capture testing system according to an embodiment of the present disclosure.

FIG. **2** is a schematic diagram showing a movable assembly of the image-capture testing device of FIG. **1**.

FIG. **3** is a block diagram of an image-capture testing platform of FIG. **1**.

FIG. **4** is a schematic diagram of a power managing module of the image-capture testing device of FIG. **1**.

FIG. **5** is a circuit diagram of the power managing module of FIG. **4**.

FIG. **6** is a schematic diagram showing the movable assembly of FIG. **1** rotatable through 360 degrees.

DETAILED DESCRIPTION

It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale and the proportions of certain parts may be exaggerated to better illustrate details and features of the present disclosure.

The term "coupled" is defined as connected, whether directly or indirectly through intervening components, and is not necessarily limited to physical connections. The connection can be such that the objects are permanently connected or releasably connected. The term "comprising," when utilized, means "including, but not necessarily limited to"; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series, and the like.

FIG. **1** illustrates an image-capture testing device **100**. The image-capture testing device **100** can be positioned on a machine **200** (shown in FIG. **2**). The image-capture testing device **100** includes a movable assembly **10** and a fixing assembly **20**.

As illustrated in FIG. **2**, the movable assembly **10** is positioned on a turntable **201** of the machine **200** and rotates along with the turntable **201**. The fixing assembly **20** is positioned below the machine **200** and is in communication with a computer **300** by a signal line. The signal line can be, but is not limited to, a USB 3.0 signal line.

The movable assembly **10** includes a fixture **12**, a first signal transfer board **13**, and a first wireless transmission module **14**. The fixture **12** may be in a lotus-leaf shape. The fixture **12** is configured to receive a camera module **11**. The fixture **12** is further electrically connected to the camera module **11** for receiving an image signal from the camera module **11**.

The first signal transfer board **13** is positioned at one side of the fixture **12** away from the camera module **11**. The first signal transfer board **13** is electrically connected to the fixture **12**.

The first wireless transmission module **14** is positioned at one side of the first signal transfer board **13** away from the fixture **12**. The first wireless transmission module **14** can be a wireless transmission chip and is electrically connected to the first signal transfer board **13**.

In this embodiment, the first signal transfer board **13** is configured to receive the image signal from the fixture **12** and send the received image signal to the first wireless transmission module **14**. The first wireless transmission module **14** then sends the received image signal to the fixing assembly **20**.

The fixing assembly **20** includes a second wireless transmission module **21**, a second signal transfer board **22**, and an image-capture testing platform **23**.

The second wireless transmission module **21** is wirelessly connected to the first wireless transmission module **14**. The second wireless transmission module **21** is configured to receive the image signal from the first wireless transmission module **14**. The second wireless transmission module **21** further transmits the image signal to the second signal transfer board **22**. In one embodiment, the second wireless transmission module **21** can be a wireless transmission chip.

The second signal transfer board **22** is positioned at one side of the second wireless transmission module **21** and is electrically connected to the second wireless transmission module **21**. The second signal transfer board **22** is configured to receive the image signal from the second wireless transmission module **21** and transmit the image signal to the image-capture testing platform **23**.

As illustrated in FIG. **3**, in one embodiment, the image-capture testing platform **23** is positioned at one side of the second signal transfer board **22** away from the second wireless transmission module **21** and is electrically connected to the second signal transfer board **22**. The image-capture testing platform **23** includes a control module **231** and an analysis module **232**.

The control module **231** is electrically connected to the second signal transfer board **22** and is configured to output a control signal to the camera module **11** for controlling the camera module **11** to capture images. The control module **231** further outputs the signals as to images captured.

The analysis module **232** is electrically connected to the second signal transfer board **22** and is configured to receive the image signal from the second signal transfer board **22**. The analysis module **232** further processes the image signal into a photo signal and then transmits the photo signal to the computer **300** through the signal line. In one embodiment, the photo signal processed by the analysis module **232** can be displayed on the computer **300**.

The computer **300** is configured to display an image based on the received photo signal. In this way, a quality of the camera module **11** is assessed by observing the image.

As illustrated in FIG. **4**, in this embodiment, the image-capture testing device **100** further includes a power management module **30**. The power management module **30** is positioned on the first signal transfer board **13**. In one embodiment, the power management module **30** includes a power unit **31** and a power indicator light **32**. The power unit **31** is configured to supply power to various components or units of the image-capture testing device **100**, for example, the movable assembly **10**.

The power unit **31** can be a battery. In one embodiment, the power unit **31** includes a voltage dividing circuit (not shown). The voltage dividing circuit is configured to divide a main power supply into a plurality of voltages. For example, the voltage dividing circuit can divide a 5V voltage into voltages of 3.3V, 1.8V, and 1.2V. Further, these voltages can be separately provided to each unit or component of the image-capture testing device **100**.

The power indicator light **32** is electrically connected to the power unit **31** and indicates power status of the power unit **31**. Generally, when the power unit **31** is powered, the power unit **31** illuminates the power indicator light **32**. The power indicator light **33** being illuminated indicates that the power unit **31** can provide power. When the power indicator light **33** is not illuminated, this indicates that the power unit **31** is unable to provide power and the power unit **31** needs to be charged or be replaced.

As illustrated in FIG. **5**, in other embodiments, the power indicator light **32** can be omitted and the power management module **30** can include a power management unit **33**. That is, the power indicator light **32** can be replaced by the power management unit **33**.

The power management unit **33** is electrically connected to the power unit **31** and the computer **300**. Then, the power unit **31** sends an electrical signal to the power management unit **33**. The power management unit **33** receives the electrical signal from the power unit **31** and transmits the electrical signal to the computer **300** through an integrated circuit bus (I2C). The computer **300** reads the electrical signal from the power management unit **33** to determine whether the power unit **31** need to be charged or be replaced.

For example, if a level of power of the electrical signal received by the computer **300** is greater than or equal to a preset value stored in the computer **300**, the power unit **31** does not need to be charged or be replaced. When the level of power of the electrical signal received by the computer **300** is less than the preset value stored in the computer **300**, the power unit **31** needs to be charged or be replaced.

Referring to FIG. **1**, FIG. **2**, and FIG. **3**, when the image-capture testing device **100** is used, the power unit **31** is firstly activated to enable the power unit **31** to supply power. Then, the control module **231** controls the camera module **11** to capture photos and send an image signal. The camera module **11** transmits the image signal to the first wireless transmission module **14** through the fixture **12** and the first signal transfer board **13**. The first wireless transmission module **14** then wirelessly transmits the image signal to the second wireless transmission module **21**. The second wireless transmission module **21** receives the image signal and transmits the image signal to the analysis module **232** through the second signal transfer board **22**. The analysis module **232** processes the image signal into a photo signal and displays the photo signal on the computer **300** for quality assessment.

In this embodiment, the first wireless transmission module **14** and the second wireless transmission module **21** are limited in respect of distance and bandwidth. For example, when the first wireless transmission module **14** and the second wireless transmission module **21** are a short distance apart, then the first wireless transmission module **14** and the second wireless transmission module **21** require a high frequency wireless communication. When the first wireless transmission module **14** and the second wireless transmission module **21** are a long distance apart, the first wireless transmission module **14** and the second wireless transmission module **21** require a low frequency wireless communication.

In this embodiment, the distance is a distance between the first wireless transmission module **14** and the second wireless transmission module **21**. Therefore, when the image-capture testing device **100** operates over a short distance, the first wireless transmission module **14** and the second wireless transmission module **21** may be wireless modules that can transmit high frequency signals. When the image-capture testing device **100** operates over a long distance, the first wireless transmission module **14** and the second wireless transmission module **21** may be wireless modules that can transmit low frequency signals.

In this embodiment, since the camera module **11** needs to load an initial value, the first wireless transmission module **14** and the second wireless transmission module **21** may be modules having a micro control unit (MCU). Then the first wireless transmission module **14** and the second wireless transmission module **21** can transmit signals after loading the initial value, thereby avoiding the loading of the initial value when the turntable **201** rotates each time.

Referring to FIG. **2** and FIG. **6**, in this embodiment, four image-capture testing devices **100** for example can be placed on one machine **200**. Then multiple camera modules **11** can be tested simultaneously.

In this embodiment, an image-capture testing system **1** is further provided. The image-capture testing system **1** includes at least one image-capture testing device **100**, a machine **200**, and a computer **300**. The at least one image-capture testing device **100** is positioned on the machine **200**. The at least one image-capture testing device **100** is configured to test the quality of the camera modules **11**. The at least one image-capture testing device **100** is electrically connected to the computer **300**. The at least one image-capture testing device **100** outputs image signals to the computer **300**, and the computer **300** determines whether a quality of the camera module **11** is high quality and fit for being passed or otherwise.

For example, in this embodiment, the image-capture testing system **1** includes four image-capture testing devices **100**. Each image-capture testing device **100** corresponds to one camera module **11**. When a camera module **11** is first tested, the turntable **201** is rotated 90 degrees along a predetermined direction, for example, clockwise, for testing a second camera module **11**. In this way, according to the predetermined direction, the turntable **201** is sequentially rotated while the four camera modules **11** are tested.

In this embodiment, the first wireless transmission module **14** performs wireless signal transmission with the second

wireless transmission module **21**, then when the image-capture testing system **1** realizes 360 degrees of rotation, a problem of winding wires of the turntable **201** in the machine **200** during rotation is avoided, thereby achieving an improvement of transmission efficiency.

It is believed that the embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the scope of the disclosure or sacrificing all of its advantages, the examples hereinbefore described merely being illustrative embodiments of the disclosure.

What is claimed is:

1. An image-capture testing system, the system comprising:

a machine comprising a turntable;

a computer; and

a plurality of image-capture testing devices, each of the plurality of image-capture testing devices comprising:

a movable assembly, the movable assembly of each of the plurality of image-capture testing devices positioned on the same turntable and rotated with the turntable, the movable assembly comprising a first wireless transmission module, the first wireless transmission module configured to receive an image signal from a camera module; and

a fixing assembly positioned below the turntable and electrically connected to the computer, the fixing assembly comprising a second wireless transmission module;

wherein the second wireless transmission module is wirelessly connected to the first wireless transmission module and receives the image signal from the first wireless transmission module.

2. The system of claim **1**, wherein the computer receives the image signal from the camera module and determines whether a quality of the camera module is qualified.

3. The system of claim **1**,

wherein the movable assembly further comprises a fixture and a first signal transfer board, the fixture is configured to receive the camera module and is electrically connected to the camera module, the first signal transfer board is positioned at one side of the fixture away from the camera module and is electrically connected to the fixture; and

wherein the first wireless transmission module is positioned at one side of the first signal transfer board away from the fixture and is electrically connected to the first signal transfer board, the image signal is transmitted from the camera module to the fixture, the first signal transfer board, and the first wireless transmission module in said order.

4. The system of claim **3**, wherein the fixing module further comprises a second signal transfer board and an image-capture testing platform, the second signal transfer board is positioned at one side of the second wireless transmission module and is electrically connected to the second wireless transmission module, the image-capture testing platform is positioned at one side of the second signal transfer board away from the second wireless transmission module and is electrically connected to the second signal transfer board; wherein the second wireless transmission module receives the image signal from the first wireless transmission module and transmits the image signal to the second signal transfer board and the image-capture testing platform.

5. The system of claim **4**, wherein the image-capture testing platform comprises a control module and an analysis module, the control module is configured to output a control signal to the camera module for controlling the camera module to output the image signal, the analysis module is configured to receive the image signal from the second signal transfer board, processes the image signal into a photo signal, and transmits the photo signal to the computer.

6. The system of claim **1**, wherein each of the plurality of image-capture testing devices further comprises a power management module, the power management module is positioned on the first signal transfer board and supplies power to the movable assembly.

7. The system of claim **6**,

wherein the power management module comprises a power unit and a power indicator light, the power unit is electrically connected to the movable assembly for supplying power to the movable assembly;

wherein the power indicator light is electrically connected to the power unit for indicating power states of the power unit.

8. The system of claim **6**,

wherein the power management module comprises a power unit and a power management unit, the power unit is electrically connected to the movable assembly for supplying power to the movable assembly;

wherein the power management unit is electrically connected to the power unit and a computer, the power unit sends an electrical signal to the power management unit, the power management unit receives the electrical signal from the power unit and transmits the electrical signal to the computer, the computer reads the electrical signal to determine whether the power unit be charged or replaced.

* * * * *